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A Case Study in Applying Green Logistics to Business Practices

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Abstract—**Green Logistics is at its initial state among pharmaceutical logistics service providers and has not yet widely been applied in Thailand's pharmaceutical industry. Various studies explored and addressed the business practices by applying green concepts as a new strategy for sustainable growth since the mid 1990's. This study attempted to address features and activities of green logistics development process through a case study company. The study began with a literature review to understand the concepts of green logistics, green process innovation and green business practices. An observation research was applied to understand the details of the values and beliefs held by members of the population and explore the activities that should be addressed to improve company's carbon emission, defining proper carbon sources, carbon intensity compared to sales value, transactions and cost saving. The green logistics model was applied through the ordering process and the outbound logistics processes of the case study company. The data of the case study was analyzed based on evidence from various sources by using analytic techniques. The results of applying the green logistics model resulted in the reduction of carbon emissions from 0.32 tCO2e to 0.27 tCO2e, in terms of sale value one million baht and cost reduction approximately 37 million baht for project projection.**

Keywords— **green logistics, green process innovation, supply chain management and carbon emission**

I. INTRODUCTION

Several organizations have become sensitive for their business operations being in harmony with the environment and local community. The commitment to reduce the impact to environment is a key factor for competitive scenarios while companies worldwide are continuously trying to develop new and innovative ways to enhance their global competitiveness. According to the International Energy Agency (IEA) the report of the world's CO2 emissions in 2006 were 28 billion tons (gigaton, Gt), among which the transport sector was responsible for 23%, or 6.45 Gt. The United States and China issued two-fifths of the world's CO2 emissions and Thailand is the twenty fourth country in the 2006 world ranking, it generated CO2 emission of 245 million metric tons of Carbon Dioxide, with a 44% increase from 1996. Then, the long-term sustainable society with the least possible negative environmental impact is a considerate factor for the firms to apply into their business. In response to this pressure, a new approach to logistics emerged in the early 1990's which went beyond the standard logistical imperatives for efficient, effective movement of goods. The green logistics approach is a newly emerged approach that takes into account measures for protecting the earth's environment. Logistics processes and activities have a significant effect in pollution emissions as one part in the Supply Chain Management (SCM). Therefore green supply chain and logistics have arisen in many industries and are a subject of recent researches.

In South East Asia, green concept is an initiative idea among ISO 14001 certified companies which has been realizing more to pursue environmental sustainability in the supply chain or supply chain environment management (SCEM). Many organizations implement the concept together with their suppliers by cooperating as business partners with suppliers on green product designs, holding awareness seminars, and helping suppliers to establish their environmental program (e.g. [1]). Moreover the concept of green supply chain management (GSCM) has been starting to be established among several firms (e.g.[2]). It encompasses environmental initiatives in inbound logistics, production, outbound logistics, and reverse logistics, including and involving materials suppliers, service contractors, vendors, distributors and end users working together to reduce or eliminate adverse environmental impacts of their activities (e.g. [3], [4]).

In Thailand, green strategy is being developed and implemented in certain industries including the automotive industry, transportation industry, textile and garment industry, and consumer supply chain industry. However, for some industries, green strategy is in its initial stage which includes pharmaceutical logistics service providers.

According to the Thailand Pharmaceuticals and Healthcare Report 2009 conducted by Business Monitor International Research Company addressed that the value of the Thai pharmaceutical market, estimated at THB116.11billion (US$3.40bn) in 2008, is expected to top THB161.99billion (US$5.59bn) in 2013. The growth of industry implies that more operations and logistics activities will be occurring, it will impact to the environment in both direct and indirect ways. As the pharmaceutical industry trend has been increasing and the pharmaceutical distributor is the key player among the channel intermediaries with both drug manufacturers and end-user. Also, the pharmaceutical logistics service providers supply chain system and logistics activities effect the environment while providing services to health care firms.

II. LITERATURE REVIEW

Researchers defined green concept in supply chain management from different perspectives and purpose for sustainable growth. They define green supply chain in

term of green purchasing, total quality management (TQM), inbound logistics, productions, distributions, outbound logistics, marketing, customer focus, empowerment of employee, and well managing reverse logistics for cost saving and improved customer services (e.g.[5],[6]). Other perspectives are delivering products and services to customers more environmental friendly, logistics service providers need to address more efforts on environmental issues (e.g.[7]). Several studies addressed the green supply chain management concept for sustainable growth as a frame work for studying management practices in both operations and strategic context (e.g.[8]), product design (e.g.[9]), process design, competitive advantage in resource savings, waste elimination and productivity improvements (e.g.[10]), manufacturing practices (e.g.[11]), and purchasing (e.g.[12]). More and more businesses enhance and improve the environmental demand and concerns of their customers and mitigate the impact of their production and service activities on the environment (e.g.[13]).Some researches presented the link between applying green concepts in different phases of the supply chain by including inbound functions, production or the internal supply chain, outbound functions and reverse logistics, including and involving materials suppliers, service contractors, vendors, distributors and end users working together to reduce or eliminate adverse environmental impacts of their activities (e.g.[14],[15]).

In the study by [16], ''green innovation performance'' is divided into two components in green innovation. The first one is "green product innovation", or the development of environmentally friendly products and services, including energy savings, pollution prevention, waste recycling, no toxicity or green product designs. The second component is "green process innovation" which focuses on the corporate management strategy. The result of their study showed that the performances of green product innovation and green process innovation were positively correlated to a competitive advantage for Taiwan Small and Medium Enterprise (SMEs) firms. Well-developed on green core competences, their green product innovation performance, green process innovation performance, and green image are increased and beneficial to the organizations. Also, the country's green image had a significant positive effect on the effectiveness of advertising, and reminded marketers about the importance of green image (e.g.[17]).Therefore, the more industries and countries adapt the green management as core competency, the more positive influence their green products have on their green process performance, and green image. The term of green marketing concept has become a tool for differentiating company positioning and has become a familiar buzz-phrase in recent years as organizations have targeted the environmentally conscious consumer and creative marketer and advertiser to develop a wide array of terms in order to describe the environmental impact and benefits of their products and services (e.g.[18]). The Green marketing practices are contributed by service providers through the 3R's which Reduce, Reuse or Recycle resources, are either collectively or individually and thereby embrace the green initiative (e.g.[19]). Also, the green marketing is the key challenge for green marketers to strengthen individuals' perception of the individual benefits to be gained from going green by adding more and stronger emotional values to green brands, such as offering information on environmentally sound product attributes (e.g.[20]).

The working paper of [21] defined green innovation as environmental innovations encompassing all innovations that have a beneficial effect on the environment and the results showed that the green product innovation performance and green process innovation performance were positively correlated to their green images. Therefore, investment in all three green areas was helpful to businesses.

Recent researches have explored the driver and influencing factors for adopting green supply chain practices (GSCP) which are explicit factors; technological, organizational, and environmental factors. The technological factor includes the technological knowledge transfer within the organization and increases the willingness to adopt green supply chain practices. The organizational factors are including organizational encouragement and quality of human resources, environmental uncertainty, and the factor of governmental support, including financial incentives, pilot projects, and tax breaks. The green practices can be encouraged through environmental activities by training and educating their employees to become environment-friendly workers and it can support technological knowledge transfer within the organization and, consequently, can raise the willingness to adopt green practices. Additionally the government can encourage green concepts by providing financial incentives, pilot projects, and tax breaks to stimulate the adoption of green practices for logistics industry (e.g.[22],[23])

III. METHODOLOGY

The study was designed to consist of two main parts which were exploratory research and qualitative research. The exploratory research aimed to gather preliminary information and comprehension of an issue or situation that will help define problems (e.g.[24]) The research process began with generating of ideas from the literature perspective to provide a historical view of the respective research areas and gathered all secondary data by desktop research, such as carbon emission report and Thailand health profile to understand more on empirical research, practices based evidence and relevant theory that relate to green definition, green supply chain management and green innovation that offered insights into how to develop the proposed model. This case study began to gather all potential secondary data, including carbon footprint reports, previous operations and logistics KPI reports, customer feedback reports, and related cost of operation, these data were used to define the potential activities to be for improving of company environmental performance and analysis. This research employed observing techniques as the qualitative research for the case study in order to establish general principles for exploring, investigating, and generating a new understanding (e.g.[25]) The research instrument used direct observing current practices of the case study

company to understand more details of the values and beliefs held by members of the population and explore the activities that should be addressed to improve company environmental performances, determine the proper KPI related to green performance measurement. The second step is to analyse and determine the proposed model that is planned to be implemented and examine this model within the ordering process and outbound logistics activities of the case study as exploratory case study types to explore an intervention and the real-life context in which it occurred and expected a better understanding of the phenomenon with real life contexts of green logistics innovation (e.g.[26]). This study attempted to address the features or activities of green logistics development process from different areas related to composites and analyzed the case study evidences from various sources by analytic techniques (e.g.[27])

Sample Frame

The sampling frame of this study design comprised an ISO 14000 certified pharmaceutical distribution company in Thailand, which was selected as an exploratory case study type (e.g.[26]). As the case study research method was applied in this study, the selecting sample employed a single case study and developed the proposed model with empirical analysis to test the proposed model to gain a systematic way of looking at events, collecting data, analyzing information, and reporting the results (e.g.[26], [28]). This case study is based on one of the leading pharmaceutical distributors, which gained market share approximately 37.50% from the total Thai pharmaceutical market estimated at THB 99,100 million in the year 2008 based on the IMS healthcare report, and 38% distribution coverage of 43,258 healthcare outlets in year 2006 based on the data of Thailand health profile 2005- 2007 report.

IV. DATA ANALYSIS AND RESULTS

This study defined the assessment methodology to obtain the data related to carbon footprint by observing and gathering data of activities which potentially led to greenhouse gas emissions, such as energy consumption data, including electricity, gasoline, diesel, and chemical consumption data which included the amount of using leaking refrigerants and business travel data. Then, the emission factor which is the rate of the greenhouse gas emissions for the each specific activity or fuel consumption was considered. With gathering the data from secondary data sources, the majority of emission factors used in this study was based on Intergovernmental Panel on Climate change (IPCC). This data excluded the carbon emission created from office paper due to the various types of paper to be used and limited to gain the information from its suppliers that require data collection from the plant type they use, fuel consumption, water consumption, energy consumption for producing the paper from their factory. Then, the data was classified in two components, which were the value of carbon emission that was generated by current operations and logistics activities prior to applying the proposed model related to green concept; the second part presented the current practices of operations procedures and explored the enhancement areas to implement the proposed model that reduced the environmental impact. Moreover the data was presented as approximate number due to the information and market concern.

A. Carbon Emission

According to the report of overall operations and logistics activities, the case study company generated the carbon emission approximately 9,200 tCO2e in year 2007. The 2007 carbon emission was increased from 2006 in the amount of approximate 8,000 tCO2e or 15.00% via-versa business growth more than 16% as presented in Figure 1, which implied more impact to the environment. The carbon emission of this case study was calculated from the energy consumption of fuel consumption, liquefied petroleum gas, refrigerant, grid electricity, and air transport and compared to overall business transactions in term of amount and business value. In term of business units presented in Figure 2 in year 2007, the carbon emission mainly came from transportation and distribution centers with the percentage share of 37% and 33% respectively.

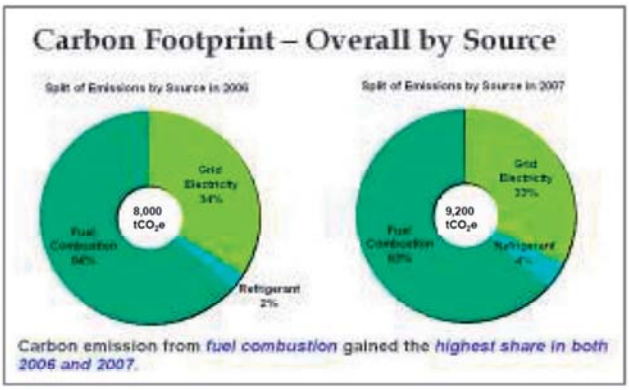

Fig. 1 Carbon Footprint results by sources

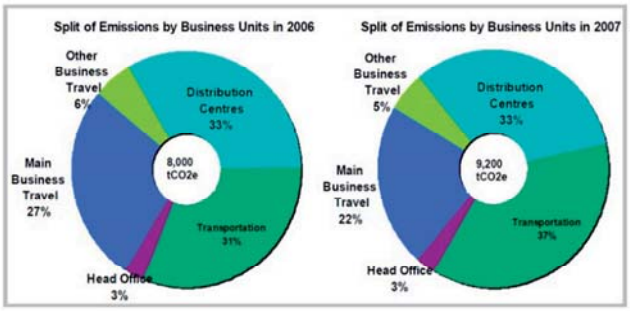

Fig. 2 Carbon Footprint Results by Business Units

The carbon emissions split by sources of year 2006 and year 2007 was presented in Table 1. The emission from fuel combustion had the highest share in both years and grid electricity was the second and refrigerant was the third emission source in year 2006 and 2007. The carbon emission from air transport gained the smallest share with the percentage share of less than 1%.

TABLE I : CARBON EMISSION SPLIT BY SOURCES (YEAR 2006-2007)

Carbon Emissions Split by Sources	2006	2007
Item	Carbon Emission (tCO2e)	Carbon Emission (tCO2e)
Grid Electricity	2,720.50	3,184.17
Refrigerant	160.00	377.90
Fuel Combustion	5,107.00	5,624.48
Air Transport	12.50	13.46
Total	**8,000.00**	**9,200.00**

B. Implementing Green Logistics Model

A case study company implemented green concept to ordering process and outbound logistics process that aimed to reduce the carbon emission figure.

1) Ordering process: According to the carbon footprint by business units report, it is assumed that one order process had the carbon impact of approximately 7.86 kgCO2e/order in year 2007 and 7.70 kgCO2e/order in year 2006. It implies that anyone mistake order that had to be reprocessed again created carbon emission of more than 7.78 kgCO2e per order in average for both years. At this point, there were enhancement areas to improve working process and to reduce the impact to environment. Firstly, the plan was called "go digital with less paper use project", which sounds simple and similar to other business green practices but it required cooperation from all staff and involved parties by looking for innovative ways to reduce resource consumption and waste, the entire office can be more economical, healthier and more productive. The company encouraged the staff to reduce the way of using paper regarding to the nature of working process and the company operated with paper-based systems. Then the highlight area that aptly demonstrates its green practice was saving paper in its working process by converting almost completely paper forms to electronic data processing to gain competitive advantage and cost saving. Secondly, applying credit card technology for order processing.

2) Outbound Logistics Process: Based on the information to address the activities for environmental improvement, there were two logistics areas considered in this study, which were shipping containers and fleet management of transportation. The ideas of changing packaging of the most valuable products were initiated as the first phase because it represented the most significant cost savings to reduce and reuse the resources by changing package from Styrofoam box to plastics box. The Styrofoam boxes are used only one time and create a negative environmental effect with large amounts of packaging being discarded at destination. In addition the process of preparing packing materials, including bubbles and ice packs collaborate with packing practice method to control the temperature, these practices affect the labor cost and environment. Then the initiation of new process of working of green concept is raised. The second area involved with speed adjustments for major cities and towns were considered to gather for traffic conditions. The new fleet management was used to calculate the time needed to deliver the product to each location. To optimize the territory, dividing delivery regions into compact territories with balanced workloads was initiated. It provided a fair allocation of work to drivers and enabled drivers to develop rapport with customers. Besides these, compact territory reduces inter-call travel time. It would use true road-based journey calculations to accurately calculate transport workloads and the compactness of each territory. The disadvantage was that too many territories would limit the amount of optimization from routing and scheduling, therefore it needed to strike a balance.

C. Results

Therefore, the cost saving for implementing the green logistics innovation model during year 2008 and the first half year 2009 of the case study could lead the company to achieve the total cost saving approximately THB 37 million for 1.5 years, since this proposed model had begun. This saving came from the decrease of fine penalties on wrong order process approximately, reducing paper use, changing the cold chain packaging, and rearranging on fleet management by rerouting, scheduling, speed adjustment and optimize the territory. However, based on the study results, adopting green innovation model in the organization were influenced by the organizational encouragement factor, which included quality of humane resources, company culture and top management support. These findings were the same as the study of [23], which concluded that organizational encouragement was the one factor had positive influences on the willingness to adopt green practices among three factors- technological, organizational, and environmental. Management, R&D, production, and marketing must be involved and committed if a firm is to implement a policy of using clean technologies. Moreover, it is found that top management support on financial investment for new packaging or process and delivery management is a crucial role to adopt and implement green process innovation, which the lacking of top management support is a major obstacle to establishing environmental policies.

V. CONCLUSIONS

Based on observing the case study company, the management team realized and pushed the green concept in their organization and company objectives. The proposed model was applied in ordering process and logistics process in order to achieve the organization objectives and goals for carbon reduction and cost saving by implementing the model to working procedures of each area. Also, to illustrate the proposed model of green concept initiated within case study company by making it to real business practices involved with many projects. As implementing paperless project within ordering team that required good management for expanding the capacity of center server for saving all reference documents into electronic files, promoted the credit card as another buying tool channels for the customer, which was an applying technology innovation to the business process and lastly applying the green concept in outbound logistics areas by using the plastic box that aims for recycling and cost saving. These practices require clear vision of the working process means finding out where resources (time, money, people, effort, etc.) are

spent on activities that do not add value to the business, and then eliminating those problems.

Consequently, the business owners and managers constantly search for ways to improve efficiency in everyday operations and ultimately increase profitability. They need a clear understanding of ongoing processes in the company to ensure that employees run their tasks smoothly and that there is no waste in the workflow. Moreover, the inbound logistics activates might need to addressed and investigate throughout the whole workflow and evaluate which activities create the impact to environment for the future study. However, companies which are pioneers in green innovations can benefit from the first mover advantage and achieve higher prices of their products and services, corporate reputation, competitive advantages, and sustainable growth.

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